

We would remark also that in his chapter on the "Theories of Microscopical Vision," Mr. Conrady adds a few paragraphs giving a short account of the connection between N.A. and the vision of minute objects of dimensions below the resolution limit, whether self-luminous or opaque.

The more important additions are those which deal with the extension of dark ground illumination to high powers, and the description of Siedentopf's apparatus for viewing ultra-microscopic particles. Dark ground illumination at high powers is obtained by the use of a condenser or illuminator of special type, which brings the light, usually with the aid of side reflection, to a focus on the specimen at a very oblique angle. Types of such condensers by Leitz, Zeiss, and Beck are described, and the method will no doubt be of value to the bacteriologist.

The Siedentopf method for illuminating ultra-microscopic particles is well known. The subject perhaps lies outside the range of the ordinary microscopist.

Finally, it may be mentioned that the already excellent series of photomicrographs has been extended by the introduction of four or five interesting photographs of amphipleura. Unfortunately, in the copy we have seen, the printers have made the mistake of printing the descriptive text on the wrong side of the thin paper separating the plates, with the result of making it somewhat difficult to read.

GEOMETRY OF SURFACES.

A Treatise on the Geometry of Surfaces. By A. B. Basset, F.R.S. Pp. xvi+291. (Cambridge: Deighton Bell and Co.; London: G. Bell and Sons, 1910.) Price 10s. 6d.

ACCORDING to his preface, Mr. Basset intends this book to supply a want in English works on solid geometry, namely, an adequate account of surfaces other than quadrics, the existing gap being due to the fact that Salmon's "Geometry of Three Dimensions" is now out of print.

The greater part of the book seems to be devoted to a detailed examination of the various types of singularities which can occur in surfaces of order not higher than the fourth; such a lengthy investigation cannot be properly criticised except at the cost of great labour. But, for reasons given below, it is doubtful if the method adopted for resolving higher singularities is really sufficient to do all that is claimed by the author.

It is not altogether clear, either, for what class of readers the book is intended; the greater part of the results will interest none but specialists in geometry. And one may imagine that such specialists might be tempted to ask why the analytical machinery is developed purely from metrical definitions, when the properties to be established are mainly projective (or descriptive) in character. Thus, *reciprocation* seems always to refer to a *sphere*, and *homogeneous coordinates* are defined (§3) only as *perpendiculars* on the faces of a tetrahedron. It is not quite easy to see how Mr. Basset would justify the use of coordinates such as $x+iy$, $x-iy$, on the last definition.

However, there is probably a wider circle of readers, not claiming to be geometrical specialists, who would

take an intelligent interest in an account of the properties of cubic and quartic curves and surfaces, and particularly in results which are related to work in other subjects. Such readers might also find it useful to have information as to various models available for the illustration of the shapes of the figures; doubtless the expert geometer disdains these mental crutches, and relies on his powers of intuition. But those of us who confess to finding it difficult to visualise surfaces from their equations, are able to point to geometrical experts who have been led to unexpected results by the consideration of models; one need only mention Kummer's model of the surface of centres of an ellipsoid (Salmon, "Geometry of Three Dimensions," p. 273), and Henrici's models of movable hyperboloids. Even expert analysts may make slips in their work, and may find occasionally some difficulty in detecting such slips, while an examination of a diagram or model will often indicate the mistake at once. An illustration may be drawn from Mr. Basset's statement (§142) that the circles of curvature at the ends of the minor axis of an ellipse can intersect at points which lie on the circles of curvature at the ends of the major axis; a moment's glance at a figure will show that the former circles lie wholly *outside*, the latter wholly *inside* the ellipse, for all values of the eccentricity.

Those who wish for an introductory account of the simpler properties of cubic and quartic curves will find Mr. Basset's provision for them rather scanty. His theorems (and proofs) occupy but little more space than the summary (of results only) given in Pascal's "Repertorio," t. ii. (1st edition); and some of Pascal's references are omitted from the list (for cubic curves) given on p. 100. A good deal of light would be thrown on the classification of quartics of the first species by a reference to the Sylvester-Weierstrass method of invariant factors. The same method would prove useful in handling cyclides (quartic surfaces), and leading up to Darboux's pentaspherical coordinates; as Darboux's coordinates are not introduced at all, Mr. Basset is unable to prove that confocal cyclides cut orthogonally, and various other theorems given in Salmon's account of cyclides have to be omitted also.

Nor will the inquirer after the arrangement of the twenty-seven lines on a cubic surface fare much better. Mr. Basset gives half a page to proving their existence, and that of forty-five triple tangent-planes, but he has no illustration to give us of even the simplest example of a double-six. Details of the singularities of the twenty-three different types of cubic surfaces are enumerated; but we are not told that, say, the cubic with a nodal line (of the first kind) can be illustrated by the familiar *cylindroid*, models of which are amongst the commonest examples of ruled skew surfaces.

The resolution of compound singularities (chapters iv. and v.) is discussed first for the case of plane curves; the method appears in all cases to rest on the assumption (see, for instance, §165) that the most general singularity of order $^1 p$ can be found on a curve

¹ We have not succeeded in finding a precise definition of what Mr. Basset means by this term: it would seem to be a singular point with p tangents (some or all of which may coincide).

of degree $p+1$. But, even for $p=2$, there is at least one compound singularity not to be found on a cubic curve; this is the cusp of the second kind, the first compound singularity resolved by Cayley. And readers familiar with such investigations as those of Zeuthen ("Math. Annalen," Bd. x.), or Jordan ("Cours d'Analyse," t. i., chapter v.), will recall that it is often necessary to go to terms of quite high order before we can obtain the precise equivalents of any given singularity. It is therefore open to question whether Mr. Basset's cases really include all types of singularity, even for plane curves; and, in the case of surfaces, the method adopted is similar (see, for instance, §§194, 196), so that it is apparently subject to the same kind of objection.

Readers of Mr. Basset's "Treatise on Cubic and Quartic Curves" will recollect his fertility in the invention of new terms, such as *anautotomic*, *aperigraphic*, *endodromic*, and so on. We miss the last pair of words in the present book, but *autotomic* and *anautotomic* are to be found on nearly every page, and occasionally new phrases, such as *tritactic*, *quintactic*, *nodotangential*. The question as to whether *autotomic* is a suitable term for a surface having a conical point, must be left to experts to settle; but to an ordinary reader like the present reviewer, the word rather suggests a nodal line or curve on the surface. However this may be, the addition of an index, so that the definitions could easily be looked up, would be an advantage to the general reader not specially familiar with Mr. Basset's terminology.

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AMERICAN MEAT INSPECTION.

American Meat and its Influence upon the Public Health. By Dr. Albert Leffingwell. Pp. xii+208. (London: George Bell and Sons, 1910.) Price 3s. 6d. net.

DURING the early period of the year 1906 the world was startled by revolting disclosures concerning the stockyards and great packing houses of Chicago, and the conditions which were then described as prevalent were certainly a menace to the public health. Since then the general public in America and England have been under the impression that permanent and satisfactory reforms have been instituted, which have led to the rectification of the abuses then disclosed. But the writer of this work, while conceding that certain improvements have been made, finds a great deal to take exception to with reference to the quality of the meat which is produced both for home consumption and export purposes. He brings forward certain facts which indicate that laws passed in 1906 for the protection of the public health have been so construed and perfunctorily administered that in some most important particulars the Federal inspection of meat leaves much to be desired.

This tendency to favour a lax construction of the law is alleged to be perceptible in many directions. Consider lard, for an example. In the regulations of 1906, which were passed immediately after the outcry in that year, it is stated that no animals dying before slaughter could be brought into any establishment for

rendering. It was intended by this regulation to keep suspected carcasses away from the tanks where lard is rendered; yet in barely two years' time (April, 1908) another regulation was framed which made this prohibition dependent upon the will of an official. Again, in the 1906 regulations, extracts of meat were included with other meat-food products which were subject to the examinations required by law, yet a subsequent amendment to these regulations exempts these products from meeting the general requirements.

The author produces statistics of the number of post-mortem inspections made of carcasses condemned (both in part and in whole) among cattle and hogs for the years 1907 and 1908 respectively; and certainly the statistics of the latter year indicate a marked reduction of the amount of flesh condemned.

We are also informed that the Department of Agriculture has abandoned altogether the microscopic examination of pork for the detection of trichinæ; and the author observes that the American Government now throws the responsibility of contracting this disease solely upon the consumer, if the food should not be thoroughly cooked. Furthermore, a regulation of 1906 required that carcasses showing generalised inflammation of the lung, pleura, intestines, peritoneum, or uterus, whether in acute or chronic form, should be condemned; but in 1908 this was amended so as to deal only with *acute* inflammatory conditions.

In a popular work with a mission of this nature one naturally seeks for evidence as to whether the writer is fair, reasonable, and broad-minded—or otherwise. The charges placed before the reader in this work are independent of personal attestation, and they rest entirely upon official documents. The writer, however, expresses somewhat exaggerated views of the necessity for the condemnation of the whole of a carcass in which there is but strictly localised evidence of tuberculosis, malignant disease, &c. In no country in the world is this the practice; and the best scientific opinion would be opposed to the necessity for the enormous waste of good flesh which would result; although one cannot but sympathise with the sentimental objection to eating the flesh of a diseased animal.

It is a well-written and readable book, and its perusal leaves the impression that the meat inspection of the United States is far from satisfactory, and that much of what the writer says in adverse criticism of it is justified. There appears to be no doubt whatever that since the passing of the Pure Food Law, regulations governing meat inspection have been issued which, in a number of instances, considerably reduced the stringency and efficiency of the 1906 regulations.

The writer looks to foreign lands, and chiefly to England, for the remedy. He points out that the English people are vast consumers of American meat and meat products; and he asks whether the meat and meat products packed in tins and exported are likely to be derived from the best of that which passes muster. He hopes and believes that by the practical expression of public sentiment which will result in the lessened demand for such meat, in England and America, the evils will eventually be remedied.

In conclusion, it should be stated that the writer